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by
The Takshanuk Watershed Council

Run timing and population estimates for eulachon *Thaleichthys pacificus* in the Chilkat and Chilkoot rivers in S.E. Alaska 2010-2011.

Initial Report Year 2 of 3

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ABSTRACT

The Chilkoot Indian Association (CIA) and Takshanuk Watershed Council (TWC) initiated a study with funding from the U.S. Fish and Wildlife Service to identify the upper extent of spawning and quantify Eulachon *Thaleichthys pacificus* populations in the Chilkoot and Chilkat rivers. Population estimates of eulachon returning to the Chilkoot River were 2.2 million (95% CI 1.7 to 2.7 million) and 12.6 million (95% CI 11.5 to 12.6 million) in 2010 and 2011 respectively. The upper reach of spawning on the Chilkoot River was identified to be 1.3 km upstream of the Lutak Road Bridge in 2010 and all of the Lower Chilkoot River (2.6 Km) before entering Chilkoot Lake in 2011. In addition, eulachon crossed Chilkoot Lake in 2011 and entered the lower 150 meters of the Chilkoot River as it entered the Lake. However, spawning could not be documented and a subsample of the population resulted in 100% males. In addition, gender distribution was collected for eulachon returning to the Chilkoot River with 34% and 26% being female in 2010 and 2011 respectively.

Due to the braided nature of the Chilkat River the CIA and TWC crew were unable to capture sufficient numbers of Eulachon to provide a population estimate in 2010 or 2011. However, CIA examined 784 individual eulachon in 2010 and 990 in 2011 finding 23% to be female in 2010 and 10% to be female in 2011. The upper extent of spawning on the Chilkat River was 11.2 km upstream from the mouth of the river in 2010 and 20.6 km in 2011.

PROGRAM NARRATIVE

Eulachon *Thaleichthys* pacificus, a small anadromous smelt, are a highly nutritional fish (20% fat) within the natural food chain that are culturally significant to the native Tlingit peoples. Eulachon have been documented to spawn in ninety-five different rivers only along the North Pacific Coast (Moody 2008). The Chilkoot Indian Association (CIA) members traditionally fish for eulachon in the lower ten miles of the Chilkat River and the lower mile of the Chilkoot River, however the upper limit of spawning has not been well documented for either river. In fact, the only study to look at the extent of utilization found eulachon up to eight miles of the Chilkat River despite local Tribal member's historical accounts of catching eulachon up to ten mile (Figure 1) (Bishop et al. 1989). While there has been no documentation of the spawning range on the Chilkoot River.

Historically when developments were proposed or had already taken place (i.e. Haines Airport) there would be a rush to look at the impacts on sensitive species such as eulachon (Betts 1994). CIA and the Takshanuk Watershed Council are taking a proactive approach to document the upper extent of spawning so proposed developments can address the potential impacts in a timely manner before damage occurs. This is especially poignant considering the planned widening of the Haines Highway and the potential of a pipeline coming to Haines. These projects have the potential to impact areas where eulachon spawn.

In addition, the majority of eulachon populations have been showing declines in their populations since the 1900s (Hay and McCarter 2000). In fact, on 17 March 2010, the National Marine Fisheries Service (NMFS) listed the southern distinct population segment (DPS) of eulachon as threatened under the Endangered Species Act (ESA). While some of the declines have been well documented most populations of eulachon are either unknown or anecdotal. This is the case for eulachon populations in both the Chilkat and Chilkoot Rivers in Southeast Alaska. While the local perception is that eulachon populations are low, there has been little investigation as to the size of the population (Bishop et al. 1989; Betts 1994).

It is important for CIA members to understand the eulachon population because the eulachon fishery in Haines is primarily regulated by Tlingit harvesters rather than by external state or federal regulations (Betts 1994). This has caused concern with the Tribal Elders because there is a lack of scientific data to assist them with the management of the eulachon population. This is especially true with the recent interest of non-natives in subsistence living but lacking the traditional knowledge. This project is helping to inform CIA members so they can provide management and education to subsistence harvesters to ensure the eulachon population will perpetuate.

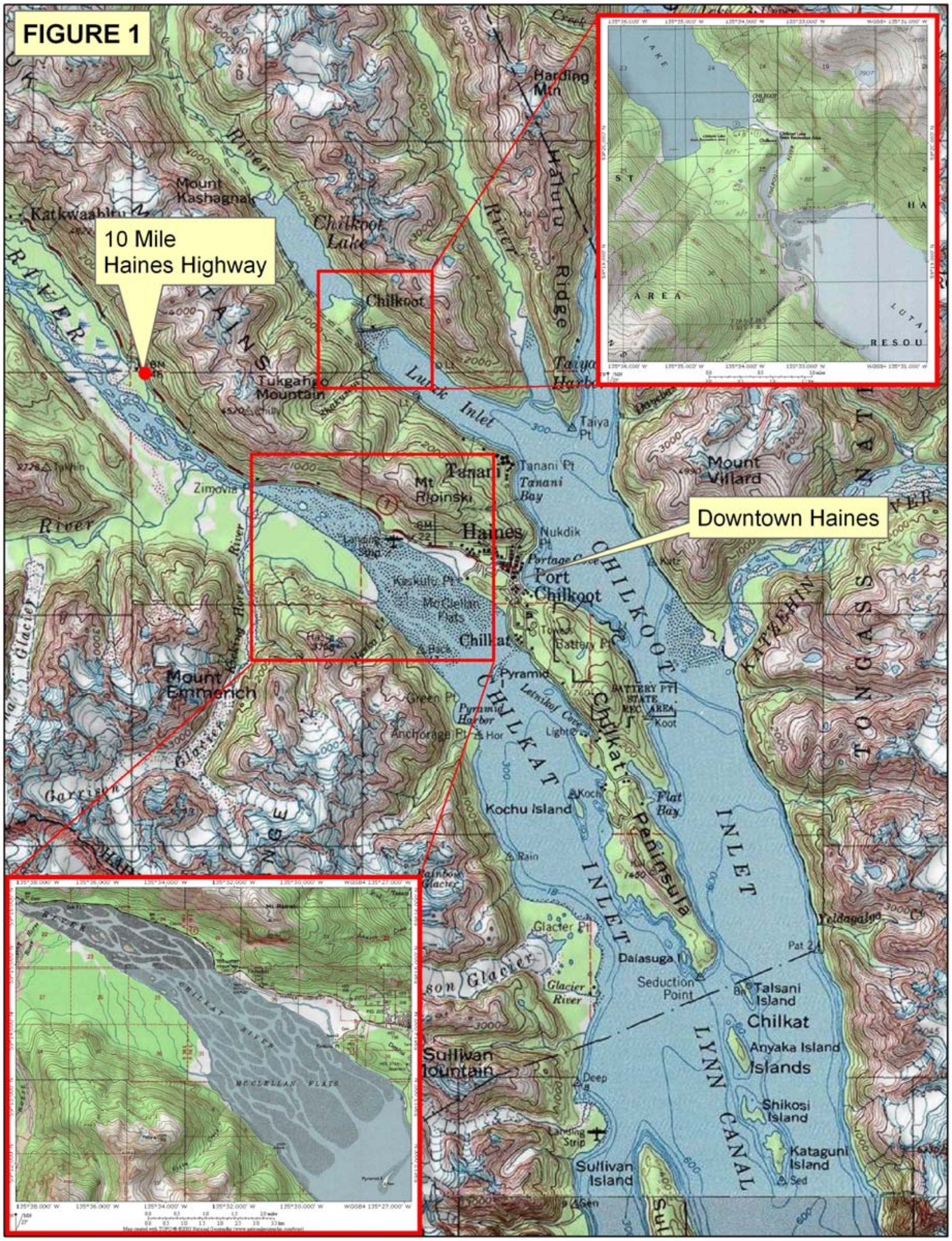


FIGURE 1
10 Mile
Haines Highway
Downtown Haines
Mount Kashagnak
Chilkoot Lake
Chilkoot
Tukgahgo Mountain
Harding Mtn
Ridge
Taiya Pt
Tanani Pt
Tanani Bay
Mt Ripinski
Tanani
Haines
Nukdik Pt
Port Chilkoot
Mount Villard
Zimovia
River
Kaskulu Pt
McClellan Flats
Chilkat
Mount Emmerich
Pyramid
Green Pt
Pyramid Harbor
Anchorage Pt
BATTERY PT STATE REC AREA
Battery Pt
CHILKOOT
INLET
CHILKAT
INLET
Chilkat
Peninsula
Kochu Island
Flat Bay
Glacier Pt
Glacier River
Dalasuga I
Seduction Point
Talsani Island
Chilkat
Anyaka Island
Islands
Shikosi Island
Kataguni Island
Sullivan Mountain
Sullivan Island
LYNN CANAL
TONGASS
Lutak Inlet
Katzehin
McCLELLAN FLATS
CHILKAT RIVER

METHODOLOGY

Eulachon larvae are believed to hatch three to six weeks after spawning and monitoring for these larvae is an accepted practice for identifying spawning areas in rivers (Flory 2008; McCarter & Hay 2003). To identify spawning habitat in the Chilkat and Chilkoot Rivers, CIA and TWC monitored both rivers for larvae starting two weeks after the first sign of adults returning to the river and six weeks after the last sign of adults in the river. Ichthyoplankton were collected using two plankton nets attached to a bongo frame and lowered into the river from an aluminum skiff or stationary platform depending on sampling location. Samples were transferred to 90% ethanol and examined for larvae.

Larvae sampling sites and timing were based on predator observations (an established method for locating eulachon) conducted from mid-April through May (Marston et al. 2002). The sampling sites were selected to identify the upstream limitation of spawning. Samples were collected on low tides to avoid larvae being displaced upstream by tidal currents.

Population estimates of eulachon in the Chilkoot River were estimated using a mark recapture method (N=[(M+1)(C+1)/(R+1)]-1) where N= total population size, M=marked initially, C=total in second sample, and R=marked recaptures. The 95% confidence intervals were calculated using the equation N=+/-(1.96)(SE). The population was estimated for an annual population.

The initially marked groups were captured within 25 meters of the Lutak Bridge (Figure 2) using modified fyke net traps and dip nets. The modified fyke net traps were modeled after traps used by the USDA Forest Service, Juneau Ranger District Biologists to trap eulachon on the Antler River in Berners Bay, AK (Image 1). The captured eulachon were transferred in small groups to plastic dishpans where they could be easily handled to clip off the adipose fin using retina scissors and returned directly to the river. To avoid excessive increases in temperature and reduce the possibility of disease transmission, the water in the dishpan was changed between each group. No anesthetic was used because many of the clipped fish were being harvested by subsistence fisherman the same day and the readily available anesthetic is not approved for consumption by the FDA.

Figure 2. Lower Chilkoot River with initial mark and release site and the recapture reach.

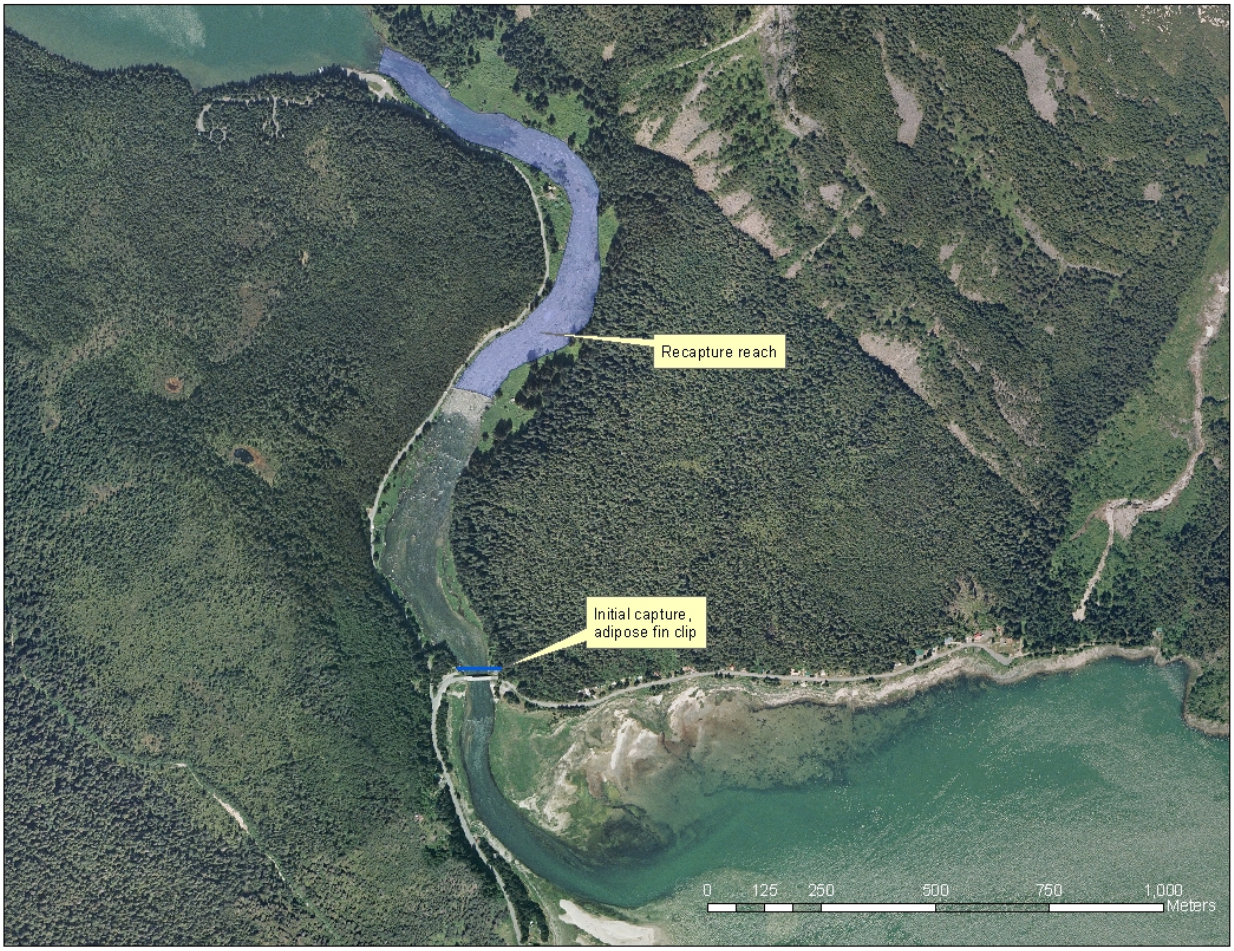


Image 1. The traps were 2.0 meters long by 1.2 meters high and 0.6 meters wide. Traps had a bottom but no top. The upstream end of the traps had a solid plywood bow to provide a refuge from the current. There was a 6 cm slit the height of the trap 2/3rds from the upstream end of the trap. Two wings 2.4 meters long and 1.2 meters high extending from the sides of the trap guiding fish into the trap. Openings where cut into the traps that could be opened to allow fish to move out of the traps when the concentration of fish was too high or when field crews left for the night.

To allow time for the marked fish to mix with the unmarked fish the recapture groups were capture between 0.75 Km upstream of the Lutak Bridge and the outflow of Chilkoot Lake. Two capture methods were used for the recapture group. When sufficient numbers of subsistence users were present the fish collected for subsistence use within the designated area were examined. When subsistence users were not present crews of two would wade the river with dip nets making sure to sample all portions of the river. The captured fish were then examined for a clipped adipose fin before releasing. To avoid repetitive sampling the same fish, the sampling crews would start at a downstream point and work their way upstream.

Sex ratio and spawning stage sampling of returning eulachon was performed daily during the run at "four-mile" and "eight-mile" of the Chilkat River and within the location of the traps and upstream of the weir on the Chilkoot River. One hundred fish were captured at each site and there sex and spawning stage was determined. The criteria used to classify spawning condition were as follows: Male spawning condition (1) pre-spawners - testes with bright white coloration and thick milt; (2) spawners - testes with dark coloration and watery milt; and (3) post-spawners – testes essentially void of milt. Female spawning condition (1) pre-spawners – eggs not expelled freely; (2) spawners – eggs expelled freely; and (3) post-spawner – ovaries essentially void of eggs (Barrett et al. 1984). Males were identified by the presence of tubercles, a large mass of muscle along the lateral line, and long pelvic fins often extending to the anus. Females were identified visually being smoother in appearance lacking tubercles (Spangler et al. 2003).

RESULTS

Population estimates for the Chilkoot River were 2.2 million (95% CI 1.7 to 2.7 million) and 12.6 million (95% CI 11.5 to 12.6 million) in 2010 and 2011 respectively (Table 1). The upper reach of spawning on the Chilkoot River was identified to be 1.3 km upstream of the Lutak Road Bridge in 2010 and all of the Chilkoot River (2.6 Km) below the lake in 2011. In addition, eulachon crossed Chilkoot Lake in 2011 and entered the lower 150 meters of the Chilkoot River as it entered the Lake. However, spawning could not be documented but their presence was not identified until most of the spawning was already completed in the lower Chilkoot River. A subsample of this population resulted in 100% males. In addition, gender distribution was collected for eulachon returning to the Chilkoot River with 34% and 26% being female in 2010 and 2011 respectively.

Table 1. Eulachon population estimates for the Chilkoot River using mark recapture techniques for a closed population.

	2010 Migration	2011 Migration
M = Marked Initially-adipose clipped	8,017	49,814
C = Total in second sample captured above weir	20,210	143,444
R = Marked recaptures above weir with clip	72	568
N^1 = Population Estimate	2.2 Million	12.6 Million
SE^2 = Standard Error	256,415	521,961
CI^3 = 95% Confidence Interval	1.7 to 2.7 Million	11.5 to 13.6 Million

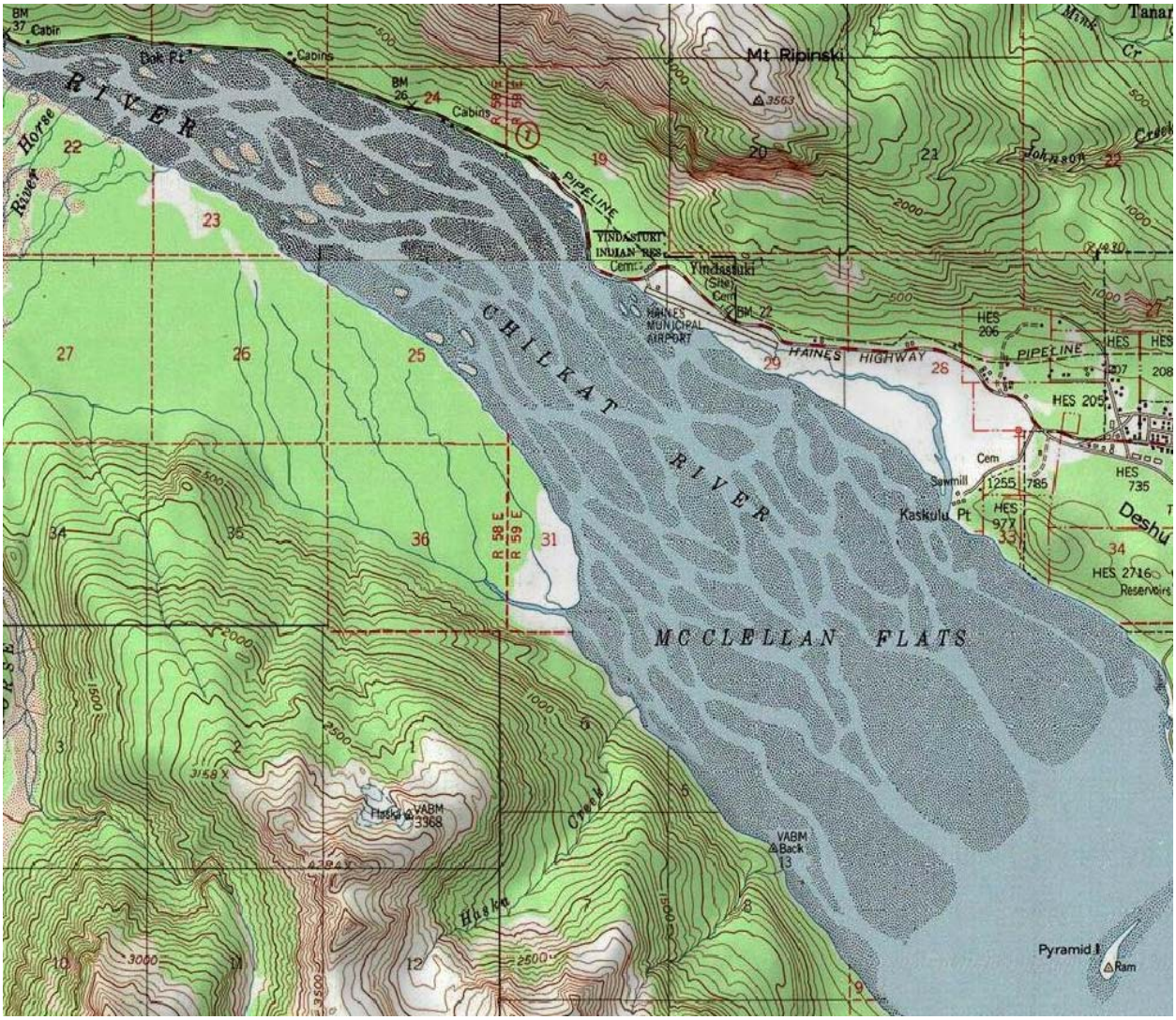
1: Equation used for population estimate. [$N = [(M+1)(C+1) / (R+1)] - 1$]

2: Equation used to calculate Standard Error. [$SE = \text{sqrt} \{ [(M+1)(C+1)(M-R)(C-R)] / (R+1)^2(R+2) \}$]

3. Equation used to calculate the 95% confidence intervals. [95% CI=N +or- (1.96*SE)]

The mouth of the Chilkat River is approximately 3.6 Km wide with a menagerie of small channels that change on a daily basis (Figure 3). Placing the modified fyke net traps in these channels along with dip netting did not provide sufficient eulachon for the initial mark group in 2010 or 2011. Therefore, there were no population estimates for either year. However, CIA and TWC examined 784 individual eulachon in 2010 and 990 in 2011 finding 23% to be female in 2010 and 10% to be female in 2011. The upper extent of spawning on the Chilkat River was 11.2 km upstream from the mouth of the river in 2010 and 20.6 km in 2011.

Figure 3: Braided channel at the Chilkat River mouth.



Compared with anecdotal evidence the run timing of both the Chilkat and Chilkoot Eulachon was early in both 2010 and 2011. Eulachon ran in the Chilkoot River from April 23rd through the 27th in 2010 and from April 28th through May 10th in 2011. Eulachon ran in the Chilkat River from April 18th through the 28th in 2010 and from April 25th through May 9th in 2011. These dates represent the bulk of the run and there could have been small numbers both before and after these dates.

CONCLUSIONS

This study has given CIA and TWC new insight into the population, spawning sites, upper extent of spawning, and sex ratio of eulachon in the Chilkoot and Chilkat rivers. The population estimate was quite successful in the Chilkoot River with its one main channel and clear water. However, the wide range of populations has made it clear that more than two years of data is necessary to monitor populations for the health of the run. While the braided nature and heavy sediment load in the Chilkat River made the methods used in this study ineffective for estimating eulachon populations. It seems that developing a population index might be a more practical solution to determining the health of eulachon populations in the Chilkat River.

The location of spawning sites and the upper extent of spawning was also straight forward in the Chilkoot River because of its single channel and clear water. However, the cloudiness and heavy sediment load in the Chilkat River made identification of spawning location difficult in the Chilkat River. While we were able to collect eggs and larvae using the plankton nets it was impractical to try and quantify or qualify the degree of spawning in the Chilkat River by location. For this reason we were limited to a presence absence result. It was also suggested that instead of sampling we use predators as an indicator of run strength and spawning locations. However, on more than one occasion in the two years of this study we would observe large concentrations of spawning eulachon with little or no predators present.

While this study has expanded our scientific knowledge of eulachon runs in the Chilkoot and Chilkat rivers it has opened up just as many questions if not more. In 2011 we documented for the first time eulachon crossing Chilkoot Lake. This brings up the question of whether this trend is going to continue and if so will the fish that cross the lake produce viable offspring. Eulachon larvae generally drift out with the current and do not actively migrate to the ocean so it seams crossing Chilkoot Lake with little current would be a limiting factor of larval migration. Another questions that came up from the 2011 Chilkoot run was that despite the fact that over 12 million eulachon returned to the river there did not appear to be large numbers of dead eulachon along the banks of the river. While we understand these are small fish it did seem there should be more carcasses around if they were all dying after spawning. Which brought about the question of what portion of the eulachon returning to the Chilkoot River might be iteroparous.

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